

Determining the Right Spinneret Inspection System for Your Plant

By Shoshana Biro
Aspex Software Engineer

Although the spinnerette appears to be essentially a simple, precisely-made extrusion die, it is one of the most critical elements of fiber making. Since they are at the very heart of the fiber-making process, plugged, dirty or damaged spinnerette capillaries can have a large impact on overall plant profitability.

Cleaning failures, damage from handling, and wear from polymer flow are the primary causes of poor spinnerette quality. Since these are everyday problems, inspection is a necessity to prevent less-than-perfect spinnerettes from being installed. There are several possible choices of inspection systems, of varying levels of sophistication. How does one select the system most efficient to their plants needs?

AUTOMATED VS. MANUAL SYSTEMS

Systems can be categorized in many ways, but that most directly related to cost and plant productivity issues are automation. Manual systems range from the purely optical (microscopes, optical comparators and hand-held magnifiers) to video based microscopes that display a magnified image on a television monitor.

On these systems the operator generally moves the spinnerette from capillary to capillary using hand-operated positioning knobs while looking at a magnified image of the capillaries. These systems rely on the operator's ability to find hard-to-see defects among the hundreds or thousands of capillaries viewed each day. The subjective judgment of the operator is the deciding factor as to how many capillaries are defective, and until which point it is acceptable to use the spinnerette in production.

In these systems, small quantities of dirt will remain undetected. In addition, the inspections are often compromised by time pressure due to the spinnerette being urgently

needed. As a result, random inspection of a few capillaries rather than a complete inspection may be done, or the inspection may be stopped before finishing. Since defective capillaries are easily missed, the entire process is highly fallible.

While the initial cost of these systems is moderate, labor costs tend to be high, especially when there are many capillaries to inspect or production requires large numbers of spinnerettes to be inspected. These factors, when combined with lost productivity, can make the true cost very high.

Fully automated systems rely on computer-based machine-vision technology to reliably and objectively inspect every capillary. The capillary pattern for each spinnerette type is stored, as are pass/fail criteria that are used to judge a clean capillary.

Using a motorized table the computer automatically moves the microscope from capillary to capillary while making inspections. The measured results are then compared by the software to the predefined standards and the spinnerette is determined to have passed or failed the inspection. The system also allows the operator to automatically go back to just the defective capillaries for re-cleaning and reinspection. During the inspection process itself the operator is free to do other jobs, minimizing labor costs.

ADVANTAGES

Although the initial cost of these systems is significantly higher than manual systems, the advantages provided in having every capillary inspected in an objective and measurable way rapidly amortize the investment due to the improved efficiency of the plant, with higher first-quality product yield, longer spinpack life, fewer spinpack start-up failures, as well as savings on inspection labor and overtime.

In addition, automatic systems can allow for the tracking of spinnerette history, which will point out problem spinnerettes, track spinnerette wear, and indicate the efficacy of the cleaning operation. By analyzing stored test results it is possible to create and evaluate "what-if" scenarios that can help to increase overall plant yield and quality, and reduce customer damage claims. Of course, buyers must be certain that the software they are receiving has all these capabilities, as some may not.

An example of this type of system is the SpinTrak spinnerette inspection system by Aspex. The system is fully automated, operates unattended, tests 100% of the capillaries, inspects as quickly as 3 capillaries per second and both provides several repeatable measurements of every capillary and stores them for either future comparisons or export to spreadsheets via the LAN.

The benefits of these capabilities and the long lifespan of the SpinTrak system is the reason that the SpinTrak systems are now found in many plants around the world and why every SpinTrak owner with multiple plants has ordered additional units for their other plants.

When making the decision of which type of system to purchase you must consider all of the costs involved. Making the decision based only on initial price may cost much more in the end. You must try to evaluate all of the cost factors involved: labor, the risk of spinpack start-up failure, spinpack lifespan, cleaning expenses, transportation and product quality. While these expenses will vary from plant to plant, the total benefits offered by automated inspection usually far outweigh their higher initial cost.